sciences, the tendency is to look forward and not backward; but it must not be forgotten that the future will be but a development of the present, as the present has been a development of the past. The evolution of chemistry has taken place along one continuous line, broken here and there by great fundamental discoveries, which have been rather apt at first to warp the line of development, and to make it a little one-sided. Thus the striking aptness of Dalton's atomic theory to explain the laws of chemical combination, which he had formulated, and the tables of proportional numbers deduced from them, attracted the attention of chemists to the determination of atomic weights. The importance of molecular weights, or as Prof. Odling preferred to call them unit weights, of compounds was not fully recognised till some half-century later, although Avogadro had pointed the way in his hypothesis put forward in 1811. In the forties Laurent and Gerhardt began to investigate unit weights, and laid the foundation of our present system. In this country Williamson and Brodie were the chief workers at the subject, and Prof. Odling described himself as their junior colleague to whose share much of the fighting fell. They had before them the problem of determining correct atomic weights for the elements, a problem which could only be solved after correct determinations of the unit weights of their compounds; and they considered that physical evidence as to unit weights must be confirmed by the chemical behaviour of substances. Hence the importance of Williamson's theory of etherification; for by showing that ether was not merely the oxide of a hydrocarbon radical, but that it was a combination of two hydrocarbon radicals with oxygen, he was able to deduce the unit weights of alcohol, ether, and other compounds compared with that of water, and to show that the carbon always combines in multiples of twelve, and oxygen in multiples of sixteen, and so these numbers must represent the real atomic weights. It was some years, however, before these new atomic weights, based on a true conception of unit weights, were generally accepted. The first text-book in which sixteen was used throughout as the atomic weight of oxygen being Prof. Odling's "Manual of Chemistry," published in 1861. Subsequently Newlands, from the revised atomic weights, suggested the periodic system of the elements, which was developed by Prof. Odling and Lothar Meyer, and completed by Mendeléeff. The chief work of chemists during the last quarter of a century might be briefly described as the investigation of the internal structure of the chemical molecule, and this, being dependent on an accurate knowledge of unit and atomic weights, is but the natural development of the most important work of the fifties—the correct determination of unit weights.

Mr. A. E. H. Love, F.R.S., Fellow of St. John's College, Cambridge, and University Lecturer in Mathematics, has been elected Sedleian Professor of Natural Philosophy in succession to the late Prof. Bartholomew Price.

Cambridge.—A Frank Smart Studentship in Botany, value 100*l.* a year for two or three years, will be vacant in June. Candidates must be B.A.s who have taken honours in Natural Science, and are of less than fourteen terms' standing. Names are to be sent to the Master of Gonville and Caius College by June 10.

Mr. A. W. Hill, of King's College, has been appointed Demonstrator of Botany.

Graces for the acceptance of the benefactions offered towards the establishment of a department of Agriculture will be submitted to the Senate on March 2.

A Salomons Scholarship of 70*l.* a year for three years will be vacant in 1900 at Caius College. Candidates will be examined in November 1899; they must be under nineteen, and must declare their intention of entering the engineering profession.

The first of a series of occasional lectures at Bedford College will be given by Dr. W. J. Russell, F.R.S., on "How pictures can be taken on a photographic plate in the dark," to-morrow, February 24.

In response to Mr. Balfour's recent appeal for the endowment of medical education and research, Sir Frederick Wills has forwarded to the treasurer of Guy's Hospital a donation of 5000*l.* to be used for the benefit of the medical school.

It is remarked in *Science* that Harvard University some time ago established a class somewhat similar to the docents of the German University, though the lectureships are limited to a period not exceeding four months, and the University does not even collect such fees as may be charged. The first lectures under this system are now announced.

The Glasgow University General Council have decided that the memorial to Principal Caird shall take the form of a window on the east side of the Bute Hall. The total cost is estimated at 900*l.*, of which 834*l.* have been subscribed. Mr. Archibald Craig, 156 St. Vincent Street, Glasgow, will be glad to receive contributions to make up the sum required to complete the memorial.

The trustees of the Reid Trust for the education of women have decided to offer a scholarship at the London School of Medicine for Women, in memory of their co-trustee, the late Miss Bostock, of Penmaen, Glamorganshire. The value of the scholarship will be 60*l.* a year, tenable for two or four years, and awarded on the result of the preliminary scientific examination of the University of London. The Bostock scholar must read for the London medical degree. Further particulars may be obtained from the hon. secretary of the Reid Trust, Bedford College, York-place, W.

In the House of Lords on Monday, Lord Norton asked the Lord President of the Council when the Education Bill would be introduced. In reply the Duke of Devonshire said that there appeared to be some misapprehension as to the character of his Bill. The Bills which he introduced last year were for the creation of a Board of Education and for the registration of teachers. Neither of those Bills could be described as an Education Bill. The measure which he should introduce would not, as far as he was aware, go beyond the scope of the Bill which he introduced last year. He hoped that next week or the following week he might be able to present the Bill again, and be able perhaps to name the day when the second reading would be taken.

The sub-committee on Commercial Education, appointed by the London County Council in May 1897, have presented their report to the Technical Education Board. The committee have considered in detail the improvements desirable in elementary and secondary schools for pupils who propose to enter on a commercial career. Among the recommendations are the following:—

(1) That it is desirable that there should be in many of the public secondary day schools in London of the second grade departments devoting themselves primarily and avowedly to the preparation for commercial life of boys who will leave school at sixteen; that in such departments, while a good general education should be given, special attention should be devoted to modern languages in such a way as to turn out pupils able to speak and correspond fluently in at least two modern languages, to the teaching of arithmetic so as to secure perfect facility in the use of the metric system, and to ensuring a good general acquaintance with the commercial geography of foreign countries

(2) That it is desirable that there should be provided in London in at least one public secondary day school of the first grade a department devoting itself primarily and avowedly to the preparation for business life of boys leaving school at eighteen or nineteen; that the curriculum of such department should not lead up to a classical or mathematical career at the Universities, but should qualify its pupils either to enter the higher ranks of commercial life, or to pursue an advanced course of study in the economic and commercial faculty of the new London University, or in other institutions of higher commercial education.

(3) That it is desirable that full and express recognition should be given to higher commercial education in the reorganisation of London University, and that it be referred to the special sub-committee of the Board, dealing with the University, to consider whether it would not be wise to urge upon the Commissioners the establishment, from the first, of a separate faculty of economic and commercial science, the provision of endowed professorships in the various subjects of higher commercial education, and such arrangements as will facilitate and encourage those designed for or engaged in the higher ranks of business to take advantage of University teaching.

SCIENTIFIC SERIALS.

Bulletin of the American Mathematical Society (January).—Report on the theory of projective invariants: the chief contributions of a decade (by Prof. H. S. White), was read before Section A of the American Association for the Advancement of Science in August 1898. The starting-point is from th

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publication of the second part of Gordan's "Vorlesungen über Invariantentheorie" in 1887. Gordan's famous theorem is on the finiteness of the form-system of one or more binary forms. After a slight introduction, the subject is discussed under six heads, viz. Mertens' demonstration and Hilbert's first proof of the theorem; Hilbert's general proof for forms in *n* variables; Deruyts' researches in enumeration of covariants of given characteristics; Hilbert's theorem upon syzygies of higher orders; miscellaneous topics; and the writer winds up with desiderata and remarks upon courses of instruction. It will be gathered from the above selection of headings that the report is likely to be useful to students. There are numerous references, which we hope are more accurate than the following footnote on the first page, which cites Sylvester's proof of the theorem; thus "Proc. Lond. Math. Soc., vol. 27 (1878), p. 11-13." There is a remarkable muddle here. Vol. xxvii. gives *Proceedings* of Session 1895-6, the *Proceedings* of 1878 appear partly in vol. ix. and partly in vol. x., and no reference to such communication occurs in the index to the first twenty volumes of the *Proceedings.*—Miss C. A. Scott discusses Holgate's translation of Reye's "Geometrie der Lage."—Prof. M. Bôcher gives an account of Burkhardt's "Funktionentheoretische Vorlesungen," vol. i., einführung in die Theorie der analytischen Functionen einer complexen Veränderlichen. The little work is said to be a useful introduction not merely to those parts of the theory which have been long classical, but also to the many other important developments of the last thirty years.—An extensive review of Darboux's "Leçons sur les Systèmes orthogonaux et les coordonnées Curvilignes," by Prof. E. O. Lovett, which follows, bristles with references to original memoirs.—Prof. J. Pierpont warmly commends the new Mathematical Encyclopædia, the success of which he regards as being mainly due to the genius, energy and courage of a single man, Felix Klein.—Errata, Notes (which are fuller than ever under Prof. Lovett's care), and new publications close the number.

Bollettino della Società Sismologica Italiana, vol. iv., 1898, No. 6.—Vesuvian notices (January-June 1898), by G. Mercalli. Describes the state of the volcano during each month, adding notes on the changes in the depth of the crater and the excentric eruptive apparatus.—Correction [of an error in copying] in the report of the geodynamic observatory of Casamicciola (Ischia) on the Indian earthquake of June 12, 1897, by G. Grablovitz.—Reply to the same, by G. Agamennone.—Mode of utilising already exhausted *Dalle-Moile* dry piles: new "Guzzanti" pile, by C. Guzzanti.—Notices of earthquakes recorded in Italy (October 2-November 26, 1897), by G. Agamennone, the most important being the earthquakes of Porto Maurizio (October 12), the Marches (October 28), Tuscany (November 1-2), and Latium (November 6 and 13), and distant earthquakes of October 18-19, 20, 23, and November 11.

In the *Journal of Botany* for January, Mr. Herbert Goss gives an account of the finding of *Orchis cruenta* in Cumberland, already alluded to in these columns.—In the number for February, Mr. G. S. West commences a list of the Alga flora of Cambridgeshire, a comparatively unworked ground. The list will comprise 409 species, 35 of them new to the British Isles, and 9 new to science, including a new *Bulbochaete* and a new *Oedogonium.*—Mr. H. C. Hart commences an account of a botanical excursion through the little-known West of Donegal.—Messrs. Britten and Boulger complete their first supplement (1893-1897) of their Biographical Index of British and Irish Botanists.

SOCIETIES AND ACADEMIES.

London.

Royal Society, February 9.—"On the Reflection of Kathode Rays." By A. A. Campbell Swinton. Communicated by Lord Kelvin, F.R.S.

The author has investigated the para-kathodic rays, so called by Prof. S. P. Thompson, which in a focus tube proceed from the front surface of the anti kathode, and cause the green fluorescence of the glass. By means of a tube in which these rays cast the shadow of a wire upon the opposite end of a tubular annex he has studied their magnetic deflection, and finds it to be in a similar direction to that of kathode rays. By means of another tube containing a small Faraday cylinder, into which some of the para-kathodic rays were caused to pass, he has determined that the para-kathodic rays carry negative charges. The author has previously shown that para-kathodic rays produced Röntgen rays, where they strike the glass; they also produce green fluorescence, hence he concludes that para-kathodic rays are simply reflected kathode rays.

The mechanical force exerted by these reflected kathode rays appears to be exceedingly small, and is insufficient to account for the inverse rotation of radiometer wheels, which, as described by the author in the *Phil. Mag.* for October 1898, occurs when the wheels are placed just outside the kathode stream. Indeed, all experiments designed to produce rotation by the impact of reflected kathode rays failed, and in some cases the wheels were found to rotate most persistently in a contrary direction, showing that whatever be the cause of such inverse rotation, it is more potent than the force of impact of the reflected rays.

The reflection of kathode rays is largely diffuse, but not altogether so; experiments with a polished concave platinum reflector, capable of rotation, gave under certain conditions distinct visual evidence of true specular reflection, with equal angles of incidence and reflection. In addition to the specularly reflected rays the anti-kathode reflector was also found under certain conditions to give off a well-defined beam of other rays normal to its surface, which caused fluorescence of the glass. The exact nature of these normal anti-kathode rays calls for further investigation.

The author has studied and quantitatively measured the electric charges carried by reflected kathode rays for different angles of incidence and reflection by means of special apparatus. A tube was constructed for this purpose, in which a polished flat platinum reflector could be set at different angles to the incident kathode rays. This tube was fitted with a movable Faraday cylinder which was capable of rotation round the reflector, so that throughout a single plane the whole field traversed by the reflected kathode rays could be explored. The amount of negative charge imparted to the movable Faraday cylinder at different positions, and with different angles for the reflector, were measured both by a reflecting galvanometer and also by a quadrant electrometer. Many complete series of observations for different positions both of reflector and cylinder were made and all agree in showing that the field of reflected kathode rays is not uniform, but increases more or less gradually on both sides up to a maximum, which always occurs almost exactly at the point that makes the angle of reflection equal to that of incidence.

Further experiments show that the amount of charge carried by the reflected rays increases as the incidence is made more slanting, and that the electrification of the reflector itself, which is strongly negative when the incidence of the primary kathode rays is normal, gradually falls to zero as the incidence is made more slanting, until with very slanting incidence the electrification becomes slightly positive.

The author compares this result with that described by him in the *Roy. Soc. Proc.*, vol. lxiii. pp. 434-435, viz. that kathode rays which strike the anti-kathode normally, are more efficient in producing Röntgen rays than those which impinge upon it very much on the slant.

The author points out that these results support the view that the Röntgen rays are actually due to the electric charges carried by the kathode ray particles being imparted to the anti-kathode.

Entomological Society, February 1.—Mr. George H. Verrall, President, in the chair.—Mr. Champion exhibited specimens of an interesting species of Fulgoridæ, *Atalanta auricoma*, Burm., recently received from British Honduras, and stated that he had found Lepidopterous larvæ in the white waxy matter attached to the body of an allied species, *Enchophora stellifer*, Burm., of which he exhibited a specimen, together with a larva taken from it. He also showed numerous specimens, and pointed out certain peculiarities, of both sexes of an undescribed species of *Apiomerus* (Family Reduviidæ) found by himself in Chiriqui.—Mr. Tutt exhibited on behalf of the Rev. G. H. Raynor a large series of *Spilosoma lubricipeda*, Linn., to show that the extreme aberrations of this species could be produced by inbreeding from comparatively normal forms. He then exhibited a number of closely allied forms of *Anthrocera*, received from M. Oberthür of Rennes, and comprising, among others, *A. medicaginis*, Dup., *A. medicaginis*, Bdv., *A. charon*, Dup., and *A. charon*, Bdv. The first two of these, as probably also the fourth, he referred to *medicaginis*, Bdv., considering them to be possibly forms of *Anthrocera lonicerea;* while the specimens of *A. charon*, Dup., were, he

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